Open Leach Reactor v1.01 — Public Disclosure & PDF Build Pack

Status: Draft public-disclosure package (blueprint + build & operating instructions)

Figure: Uploaded blueprint (Open Leach Reactor v1.01) see last page. Use this page as the authoritative drawing for the 1:1 layout. The following pages convert the drawing into a printable PDF-ready build package and step-by-step operating SOPs.

---

1. Overview

This document translates Open Leach Reactor v1.01 into a build-ready PDF and includes: - Annotated parts list and cut/ordering list - Step-by-step assembly instructions - Safety, ventilation & scrubber design - Operating procedure (bench and pilot scales) - "Clean Oxidation" option (ozone + UV driven chloride path) and the key reaction:

$$\mathrm{O_3 + 2Cl^- + 2H^+ \rightarrow Cl_2 + O_2 + H_2O}$$

- Sensors, logging & commissioning checklist

Intended use: bench-to-pilot R&D for oxidation leaching of precious metals using acetic–chloride chemistry enhanced by ozone and UV-C.

---

2. High-level functional block (as on blueprint)

1. Reactor — inverted pyramid PTFE-lined tank with quartz immersion tube(s) for UV-C lamps. Baffle and microbubbler ring below the quartz sleeve.
2. Ozone generator feeding fine-bubble micro-diffuser under the quartz sleeve.
3. Headspace routing: demister → alkaline bubbler (Na2CO3) → activated-carbon jar → final UV-C air-polish + fan → exhaust with ozone sensor.
4. Controls: ORP, pH, temperature, pressure sensor on headspace. Manual valves to isolate the reactor.

---

3. Parts & procurement list (bench/pilot)

Quantities and approximate unit notes for a 500 mL–5 L bench/pilot build.

- PTFE sheet panels (thickness 3–6 mm) — for inverted pyramid walls and lid — **5 sheets**
- Quartz immersion sleeve (for 254 nm lamp) — **1** (lab size) — ensure O-ring seals & lamp mount.
- UV-C low-pressure mercury bulb 254 nm, 13 W (spare) — **2**

- Ozone generator (120–200 mg/h) ozone-rated tubing — **1**
- Fine-bubble PTFE diffuser ring — **1**
- Silicone heating mats + PID controller (waterproof) — **1–2**
- ORP probe (industrial w/ BNC) + readout/data logger — **1**
- pH probe (lab grade) — **1**
- Temperature probe (PT100/thermocouple waterproof) — **1**
- Headspace tubing (PTFE/silicone), barbed fittings, chemical-rated clamps
- Mist trap/demister media and frit connectors
- Alkaline bubbler jar (borosilicate) + Na2CO3 (washing soda)
- Activated carbon (aquarium grade) 1–2 L granules for jar
- UV-C air-polisher (254 nm) + small radial fan
- Inline ozone sensor (safety) and chlorine detection paper (KI-starch)
- Misc: screws, PTFE sealant, acid-resistant bolts (316 SS), collection funnels, filter holders

---

4. Assembly steps — concise

1. **Panel assembly:** Cut PTFE panels to the pyramid geometry shown in blueprint. Pre-drill screw holes every 4–6 cm along seams. Assemble with acid-resistant fasteners and PTFE seam tape. Leave one panel with gasketed access port.
2. **Install quartz sleeve:** mount quartz sleeve centrally in lid/panel so its lower 1/3 can be immersed in liquid. Fit electrical feedthroughs and mechanical clamps rated for wet use.
3. **Mount microbubbler:** position PTFE diffuser ring under the sleeve. Connect ozone tubing (ozone line) to diffuser via check valve and flow-control.
4. **Sensors:** fit ORP/pH/Temp ports (Teflon bulkhead). Keep probe positions away from direct bubble impingement (to avoid false readings).
5. **Headspace plumbing:** connect top exhaust to demister jar (mesh pad), then to alkaline bubbler with Na_2CO_3 (1–5% w/v), then to activated carbon canister and final UV-C air-polisher box with fan and ozone sensor after the carbon.
6. **Electrical & safety interlocks:** wire UV lamp to a keyed switch and safety shield with interlock (lamp off if lid open). Ozone generator interlocked to fan/scrubber on.

---

5. Operating SOP (bench 500 mL test — stepwise)

Prep: verify scrubber train is charged (Na_2CO_3 in bubbler, carbon in jar), all fittings tight, sensors calibrated.

1. Add 500 mL of 20% acetic acid + NaCl (50 g). Heat to 44–48 °C. Record initial ORP/pH/Temp.
2. Add solids ($\leq$ 10 g). Start gentle mechanical stir and air purge for 5 min. OK.
3. Start ozone on pulse (15 min on / 15 min off) and turn UV (254 nm) on. Monitor ORP closely — aim to raise toward **+800–950 mV**.
4. If ORP stalls: increase ozone duty, check diffuser, add micro-pulses of 3% H_2O_2 (1 mL per 500 mL) stepwise. Log each change.

5. Hold target ORP for 30–60 min, sample filtered aliquots for SMB/ascorbic check to confirm Au in solution.
6. When ready, stop oxidants, air-purge for 10 min, filter liquor, precipitate with SMB/ascorbic, wash precipitate and save for assay.

Safety stop conditions: strong chlorine odor (stop ozone), ORP > 1000 mV, temperature > 50 °C, or excessive foaming.

---

6. Clean Oxidation Option (added)

- **Mechanism:** in acidic chloride media, ozone oxidizes Cl^- to Cl_2 (and HOCl) — a fast oxidant for sulfides and for Au oxidation when radicals are present. The key reaction is:

$$O_3 + 2Cl^- + 2H^+ \rightarrow Cl_2 + O_2 + H_2O$$

- **Implementation:** keep chloride present (moderate NaCl), use ozone microbubbling within the UV irradiation zone so dissolved ozone + 254 nm light produce hydroxyl radicals and activate chloride. Add optional 185 nm emission in industrial builds for stronger photochemical ozone production (requires heavier scrubbing).
- **ORP targets and notes:** target **+750–950 mV** for Au dissolution; avoid > +1000 mV without expanded off-gas control (Cl_2 hazard).

---

7. Safety, ventilation & waste handling (summary)

- Exhaust train: demister → alkaline bubbler (Na_2CO_3) → activated carbon → UV-C air-polish. Monitor with ozone sensor and KI-starch paper for Cl_2.
- PPE: full-face UV-C goggles, respirator for ozone/Cl_2, nitrile gloves, acid apron. Keep MSDS and spill plan at bench.
- Waste: keep spent leach liquors in labeled hazardous waste containers; recover AgCl cakes and precipitates; neutralize and dispose via licensed waste handler.

---

8. Commissioning checklist & data logging

- Calibrate ORP, pH, Temp probes. Verify quartz sleeve integrity and lamp emission. Check ozone generator output and diffuser function. Start with blank runs (no solids) to establish baseline ORP.
- Log every run: start mass, solution composition, ORP/time series, aliquot test results, precipitate mass, and final assay result.

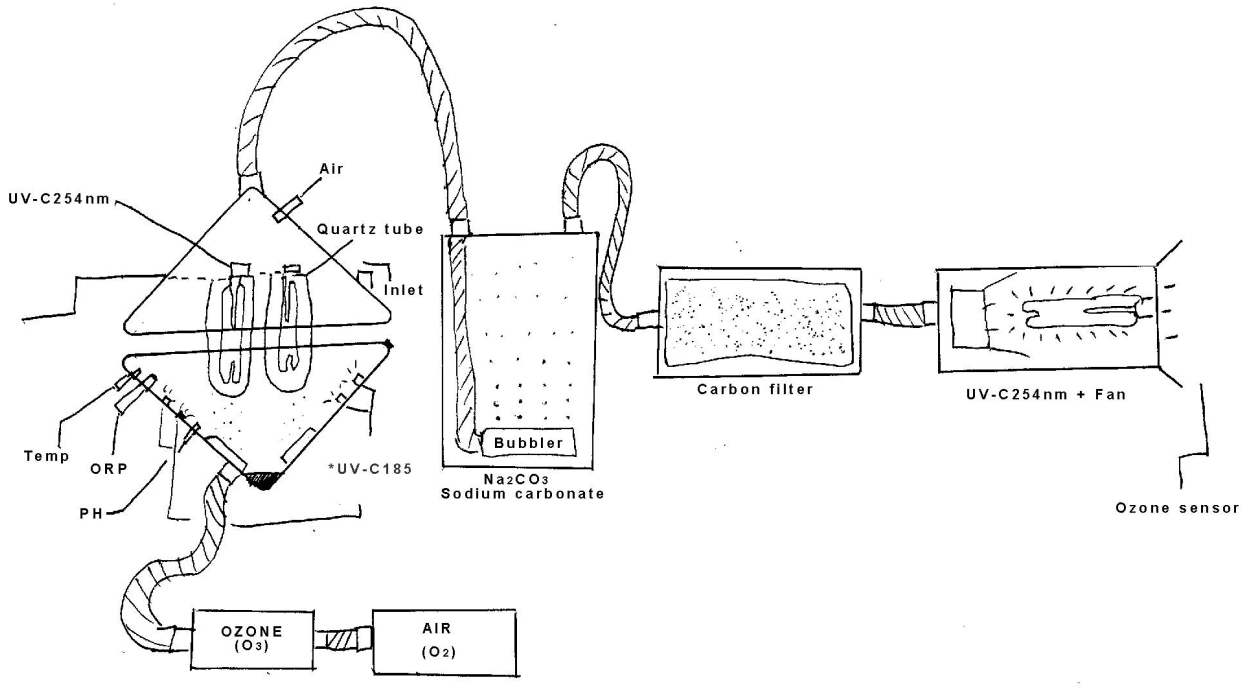
---

9. Appendix: Quick test recipes

- **Bench vinegar–chloride leach (500 mL):** 20% acetic acid, 50 g NaCl, 5–10 g solids, 44–48 °C, ozone 120–200 mg/h, UV-C 254 nm.

- **SMB precipitation (quick):** small aliquot test: add 0.1–0.5 mL of 10% stannous chloride solution to 5 mL filtered sample until floc forms; for full batch scale proportionally.

Open Leach Reactor v1.01 – Public Disclosure



*UV-C185nm For advanced industrial application

LEGAL USE TERMS

This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0). You are free to:

* Share — copy and redistribute this material in any medium or format * Adapt — remix, transform, and build upon the material

Under the following terms:

+ Attribution — You must give credit to creator ID 68743762-9fc8-800f-9477-80d448b2db34 * NonCommercial — No commercial use unless permission is granted

Use of this method, in whole or part, implies agreement to these terms. Any attempt to patent, sell, or commercially exploit this process without written consent from the original creator is a violation of this disclosure.